

Armed Forces College of Medicine

AFCM





Blood Supply of the Brain

By

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INTENDED LEARNING OBJECTIVES (ILO)

By the end of this lecture the student will be able to:

- **Describe** **blood supply of the brain.**
- **Predict** **the results of occlusion or hemorrhage of the different arteries.**



KEY POINTS OF THE LECTURE

I)Arteries supplying the brain

(a. Origin, course, termination & branches of the internal carotids, vertebral & basilar arteries)

(b. Results of occlusion or hemorrhage of the different arteries)

II)Veins draining the brain

(a. Superficial veins)

(b. Deep veins)

Blood Supply of Arterial

https://www.google.com.eg/search?sa=G&hl=en-EG&q=branches+of+arch+of+aorta

Arch of aorta
Subclavian arteries
Common carotid art
Brachiocephalic trur
Descending aorta

Two arterial systems:

1) Carotid system 2 internal carotid arteries (ICA)

2) Vertebro-basilar system 2 vertebral arteries join to form basilar artery

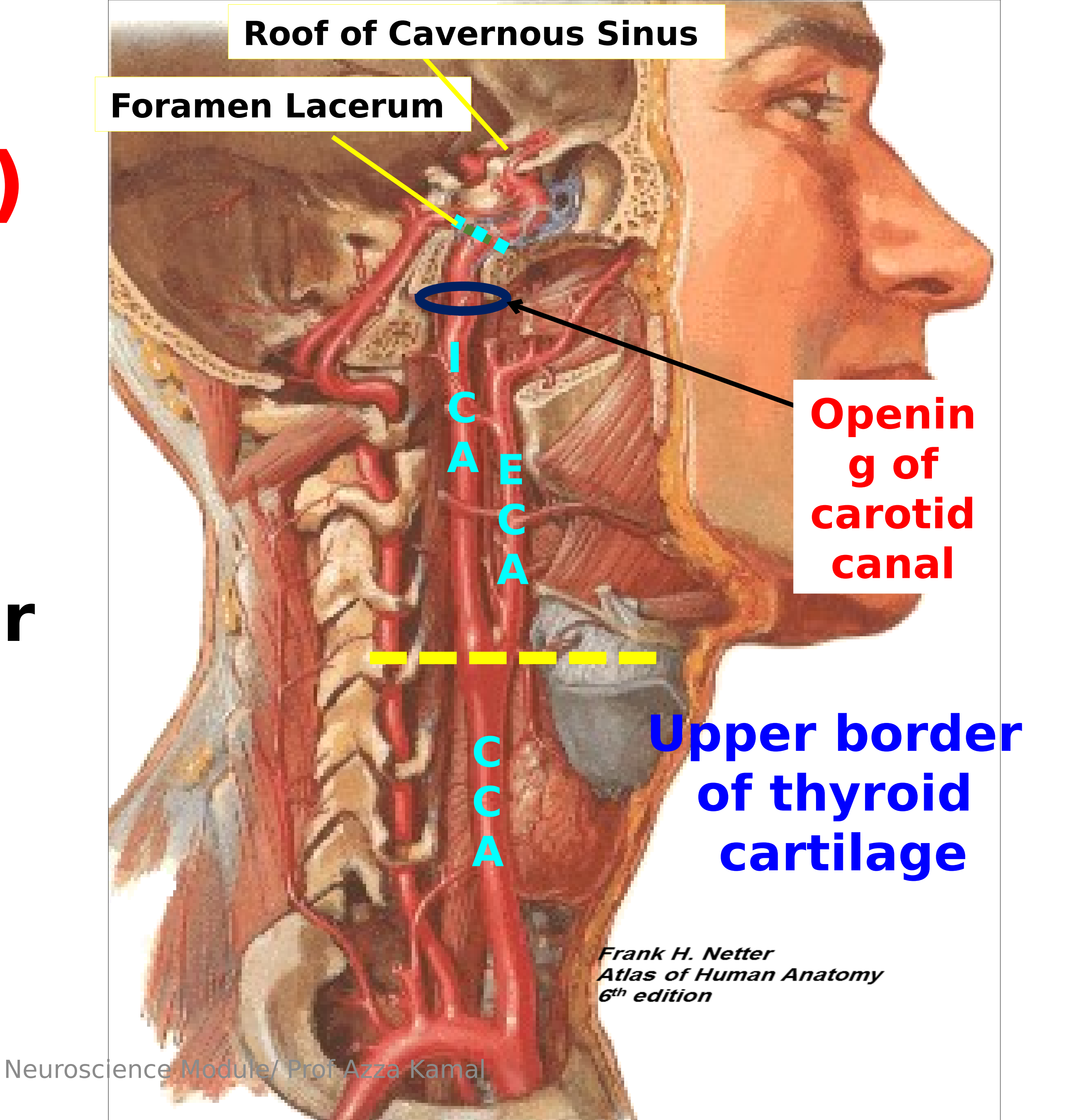
Basilar
Vertebral

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- **Both systems anastomose**

Internal Carotid A (ICA)

- **Begins:** **at bifurcation of common carotid artery (CCA) in the neck (at upper border of thyroid cartilage).**
- **Passes through carotid canal o skull foramen lacerum cranial**

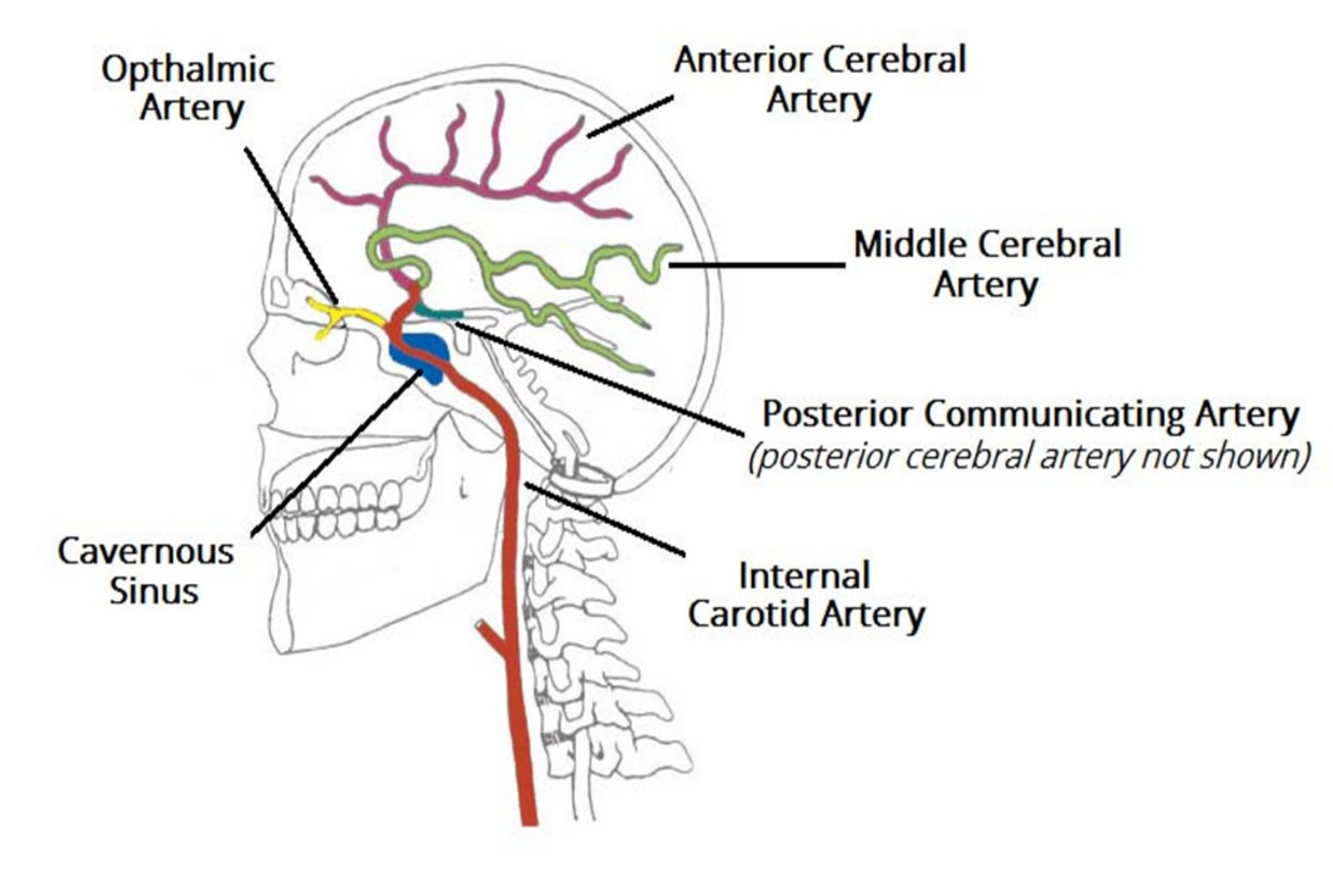


- **ICA passes through cavernous sinus gives branches to :**

1)Pituitary gland
2)Trigeminal ganglion
3)Meninges

- **It emerges through roof of cavernous sinus medial to anterior clinoid process.**

- **Then it turns posteriorly to region of anterior perforated substance**



https://www.google.com.eg/search?sa=G&hl=en-EG&q=supraclinoid+internal+carotid+artery



ICA
Cerebral Part

Ant. Clinoid process

ICA
Cavernous Part

Cavernous sinus

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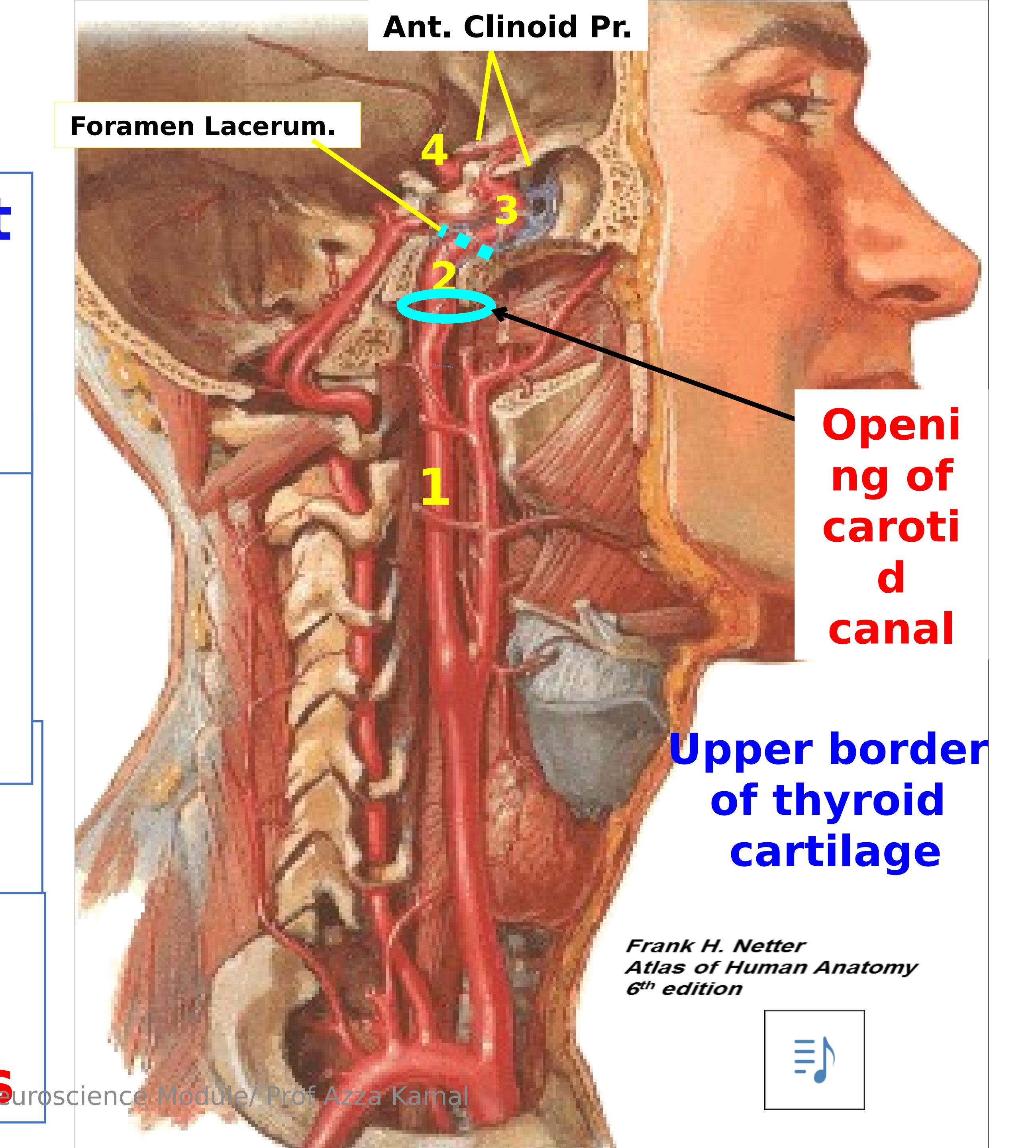
Course of ICA is divided into 4 parts:

1st part = **Cervical Part** From upper **border of thyroid cartilage** to **carotid canal**

Part passes through **carotid canal** of skull to enter cranial cavity via **foramen lacerum.**

Part runs in cavernous

4th part = **Cerebral Part** emerges through **roof of cavernous sinus**



Internal Carotid A (ICA)

Ends: opposite **anterior perforated substance** by dividing into anterior and middle cerebral arteries **(ACA & MCA)**

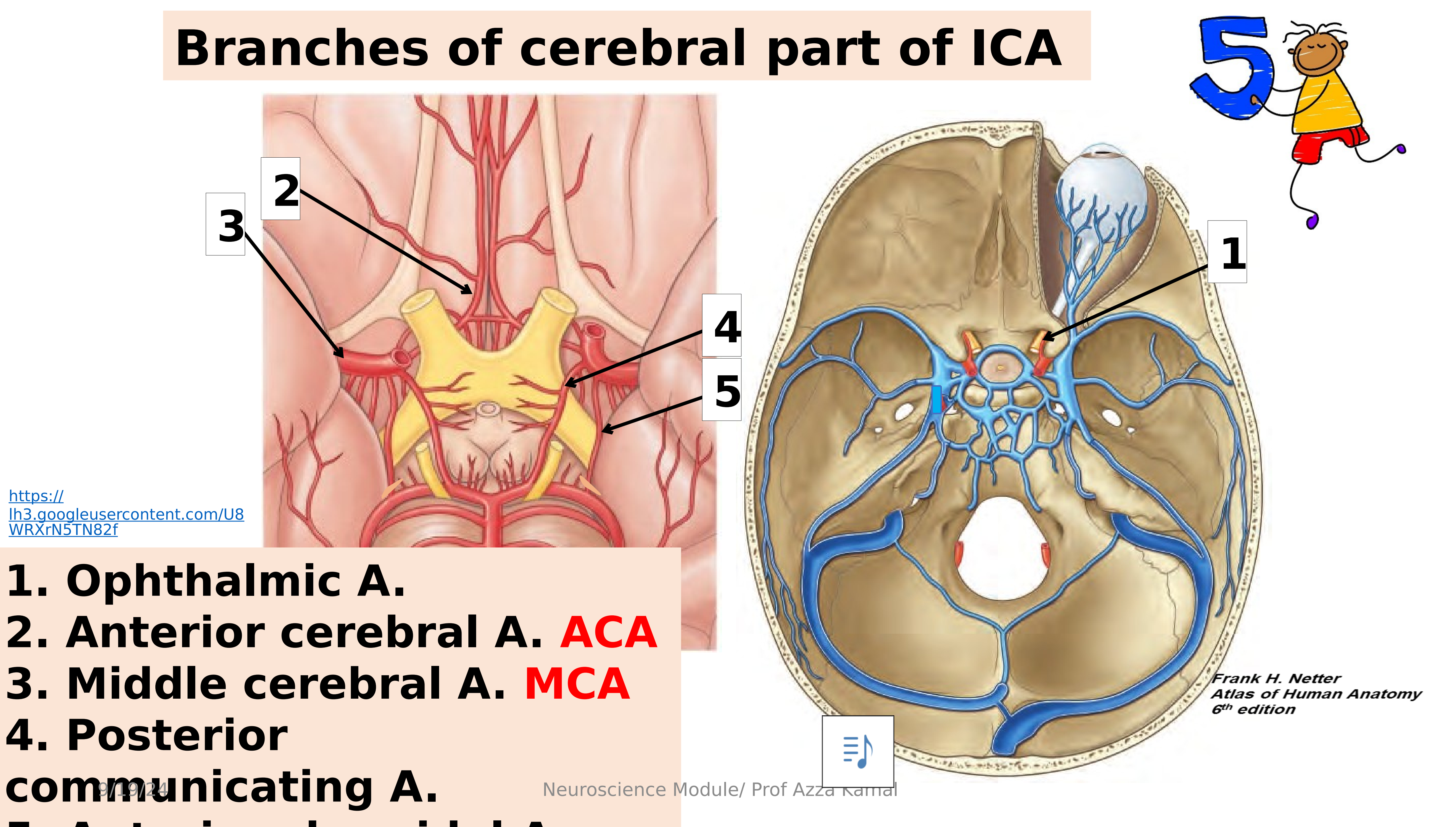
Ant. Perforated substance

ACA

MCA

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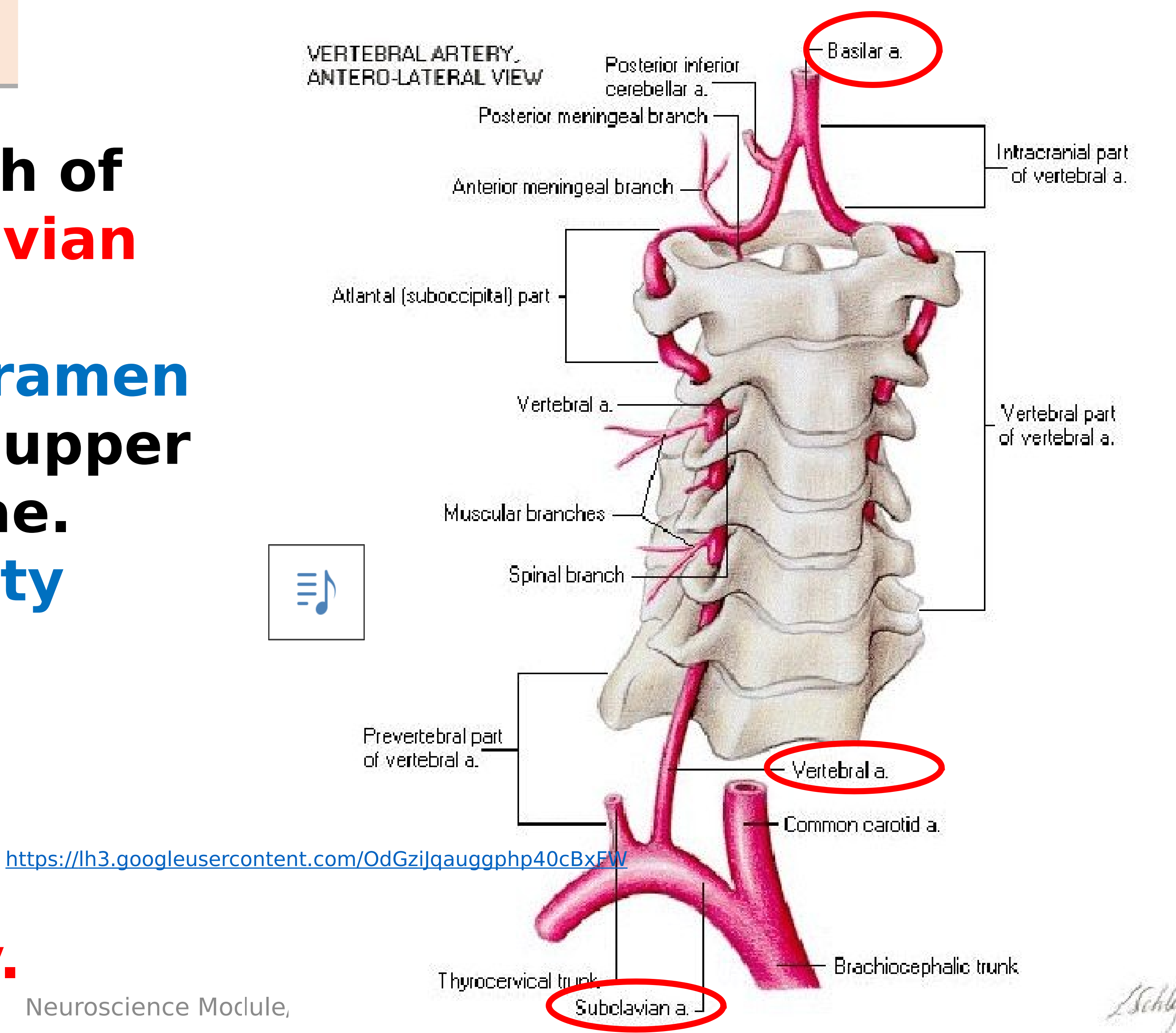




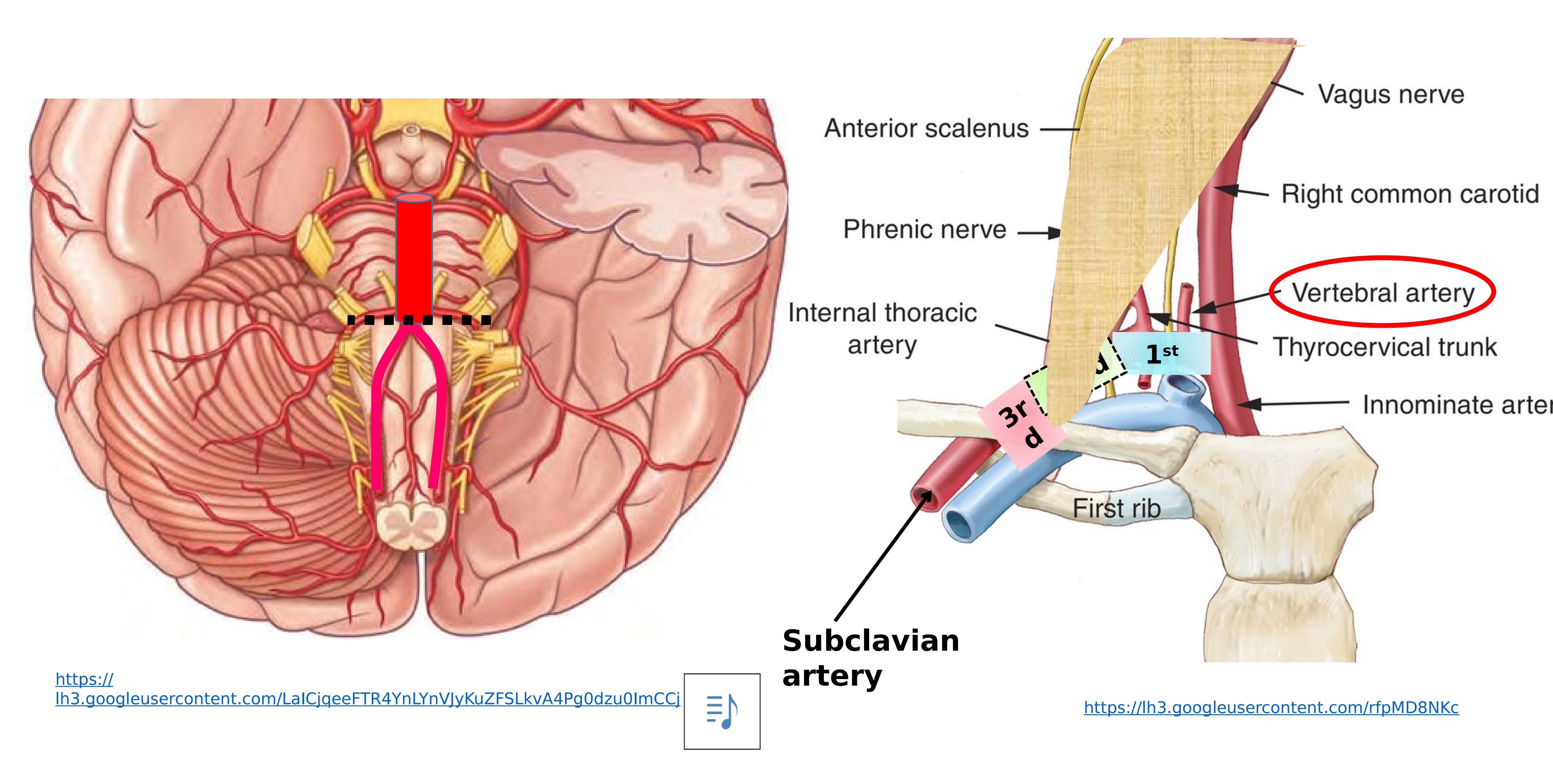
Branches of cerebral part of ICA
2
3
4
5
1
https://lh3.googleusercontent.com/U8WRXrN5TN82f
1. Ophthalmic A.
2. Anterior cerebral A. ACA
3. Middle cerebral A. MCA
4. Posterior communicating A.
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6th edition
9/19/24
Neuroscience Module/ Prof Azza Kamal

ertebral artery

- **Begins:** **as a branch of first part of subclavian artery.**
- **Passes through foramen transversarium of upper 6 cervical vertebrae.**
- **Enters cranial cavity through foramen magnum.**
- **Ends at lower border of pons by joining the other vertebral artery to form basilar artery.**



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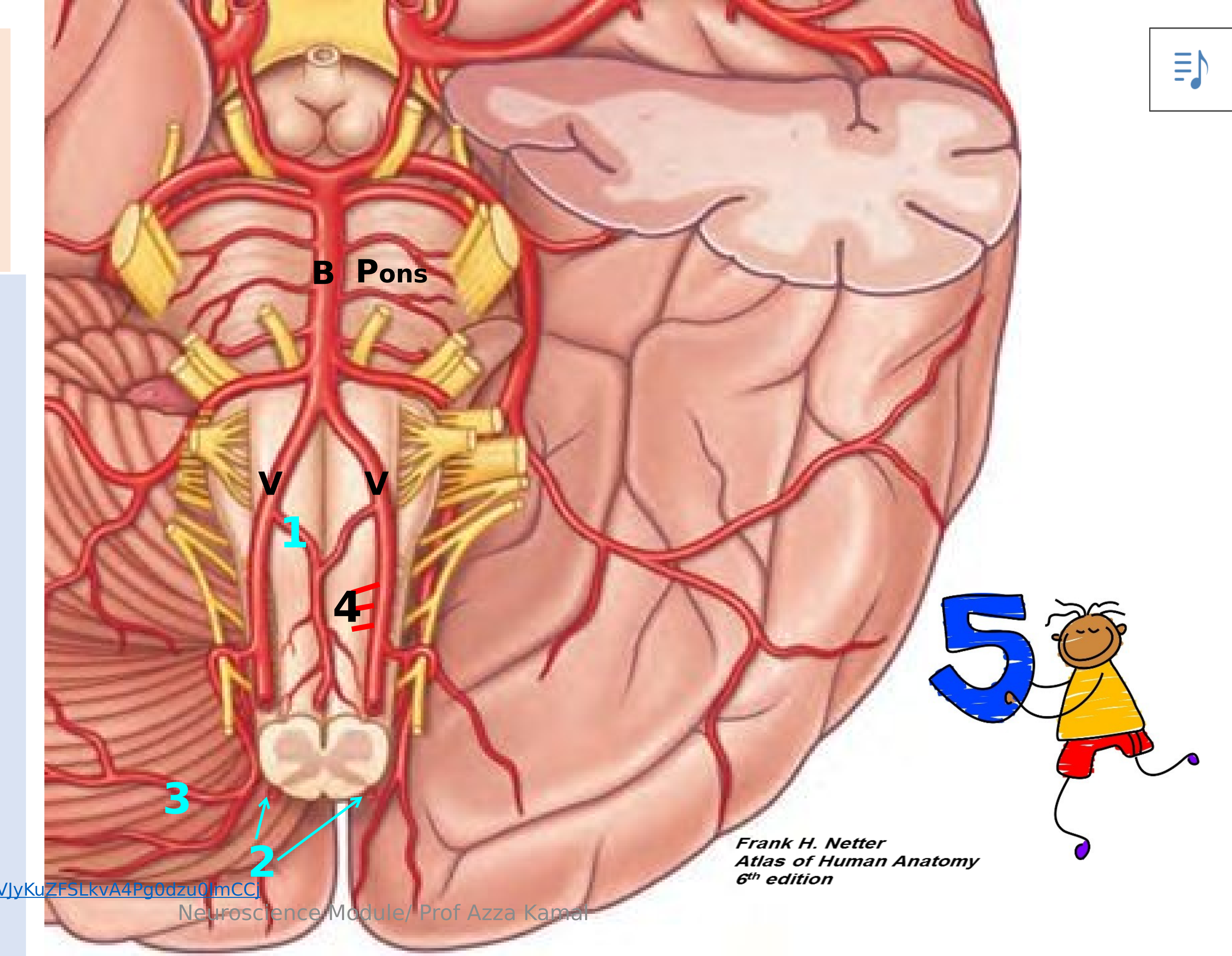


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Branches of vertebral artery (in cranial

1. Anterior spinal
2. Posterior spinal
3. Posterior inferior cerebellar
4. Medullary branches
5. Meningeal



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Basilar Artery

- **Begins** by union of right & left **vertebral arteries** at lower border of pons.

- **Ends** by giving its two terminal brs. **right & left posterior cerebral arteries** at



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Branches of Basilar Artery

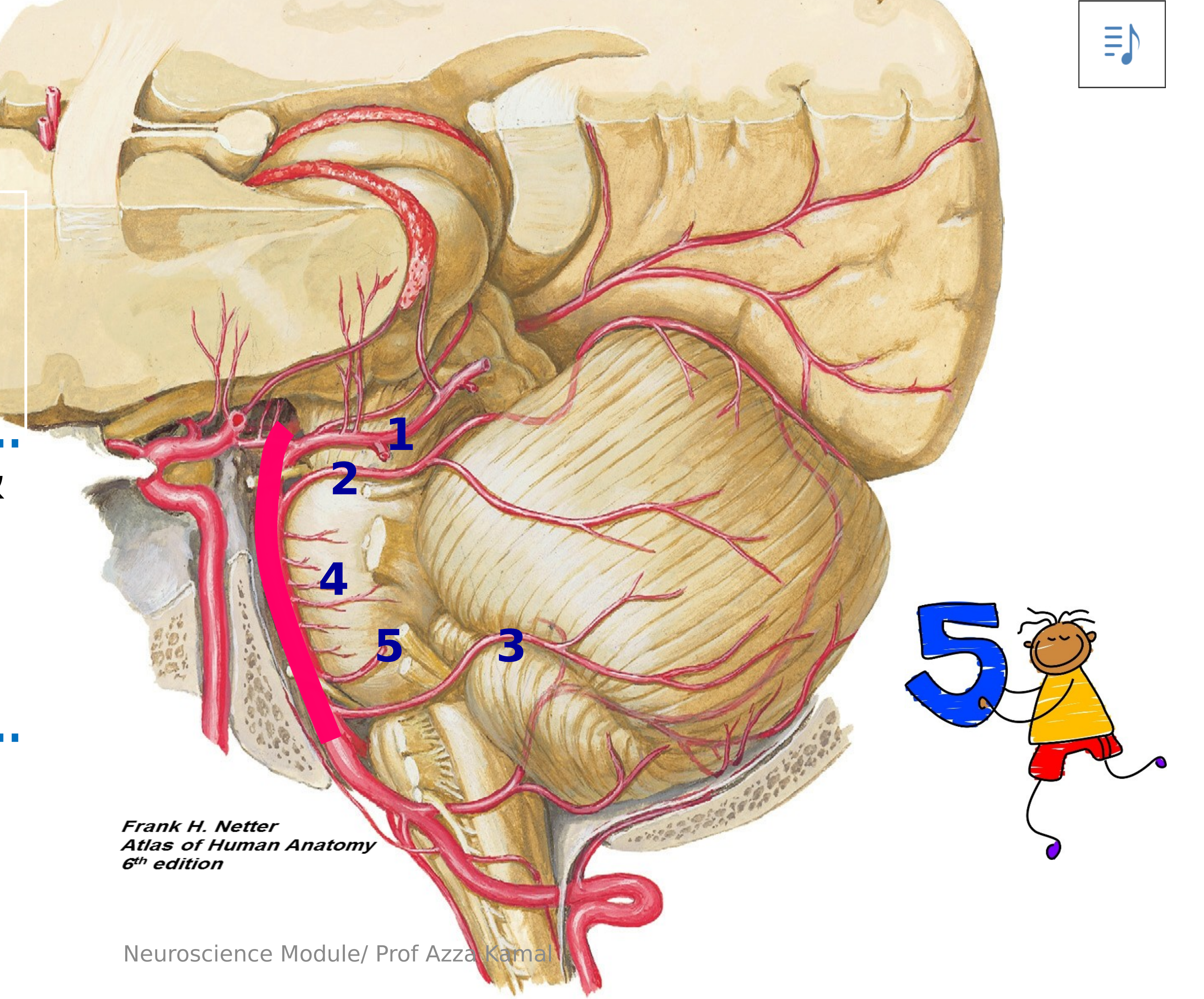
branches:

Two cerebral:

1. **Posterior cerebral A Rt & Lt PCA**

Two cerebellar:

2. **Superior cerebellar A**
3. **Anterior inferior cerebellar**



Circle of Willis
"Circulus arteriosus"

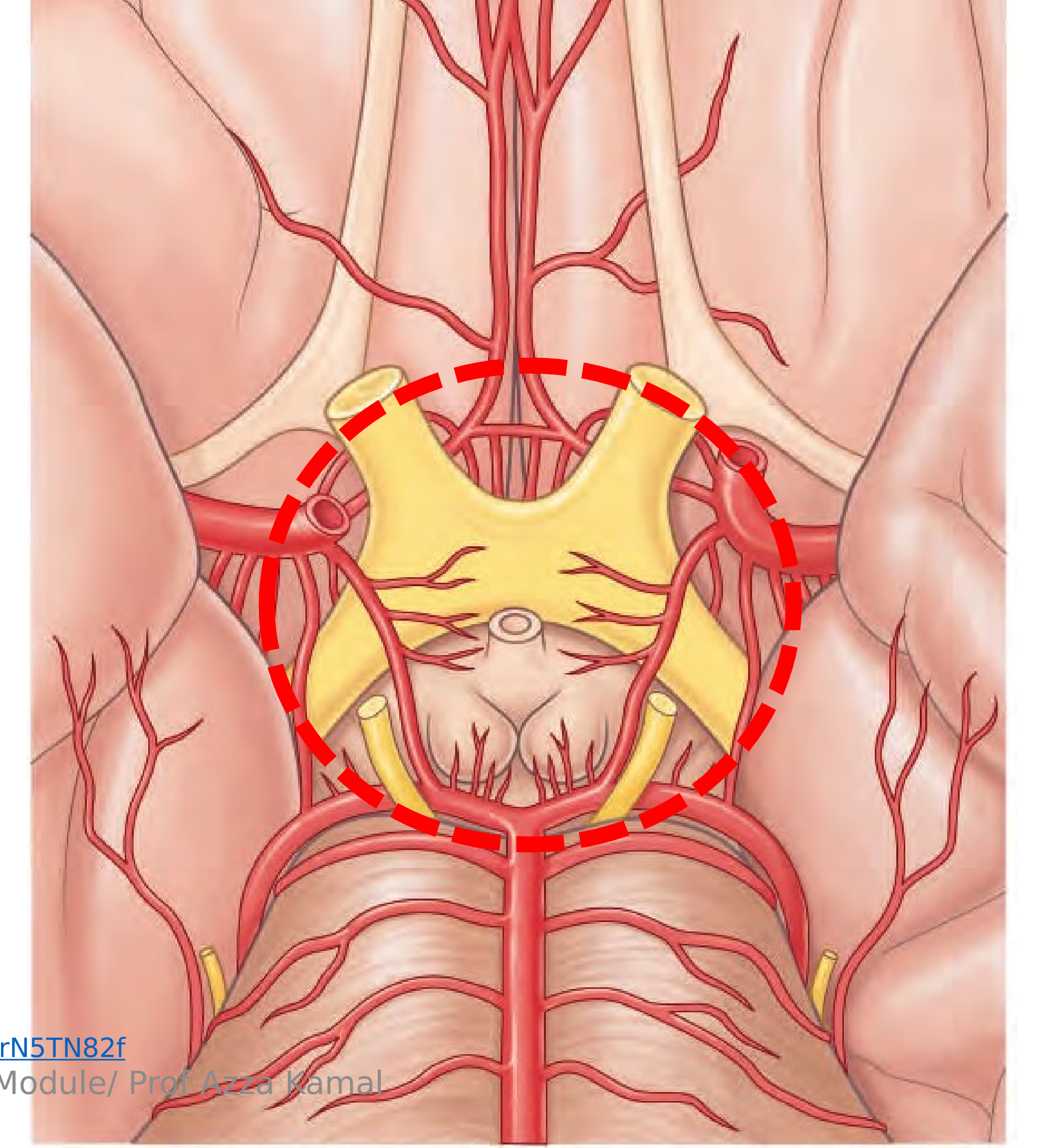
- **Definition:**

A large arterial anastomotic circle between the carotid and vertebro-basilar systems.

- **Site:**

At the base of the brain in the interpeduncular cistern.

- **Function:**

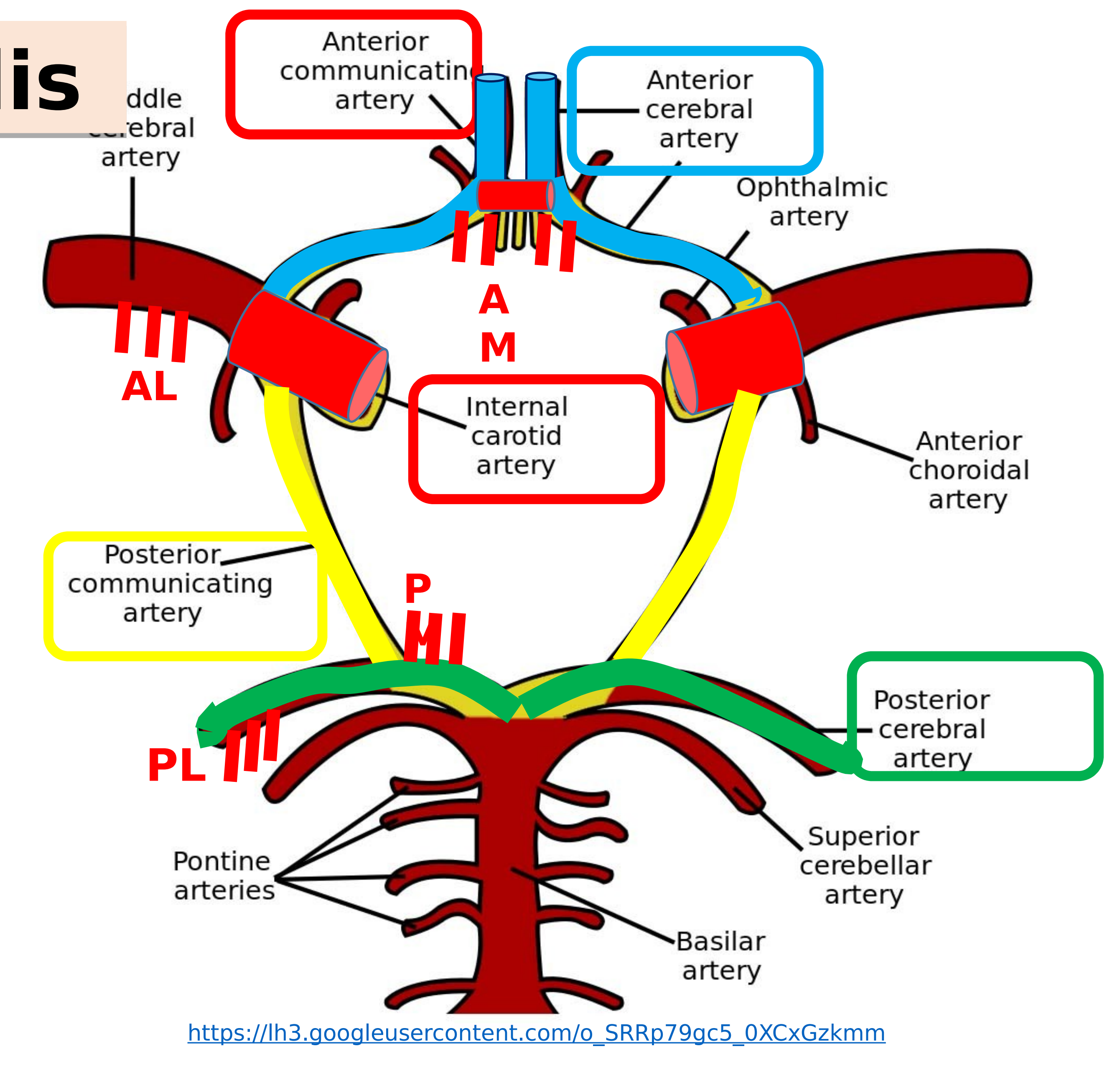


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ircle of Willis

It is formed by:

- ✓ Rt & Lt ACA with anterior communicating artery joining them.
- ✓ Rt & Lt internal carotid arteries
- ✓ Rt & Lt PCA
- ✓ Posterior communicating joining internal carotids & PCA



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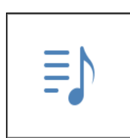
Circle of Willis gives 4 sets of central brs to supply nearby structures:

1. Anteromedial set (AM) from ACA& ant comm
2. Anterolateral set (AL) from MCA
3. Posteromedial set (PM) from PCA
4. Posterolateral set (PL) from PCA

Central Branches from Circle of Willis :

1. **Antero-medial set (AM)from ACA pierce anterior perforated substance (APS) supply caudate, lentiform & internal capsule**
2. **Antero-lateral set (AL)from MCA pierce APS supply caudate, lentiform & internal capsule**
3. **Postero-medial set (PM) from PCA pierce post. perf. subst. (PPS)thalamus & hypothalamus**
4. **Postero-lateral set (PL) from PCA supply thalamus, metathalamus & cerebral**

Cerebral Arteries





- It runs towards longitudinal fissure
- It runs backwards over corpus callosum.
- It ends at parieto-occipital sulcus by anastomosing with the posterior cerebral artery.

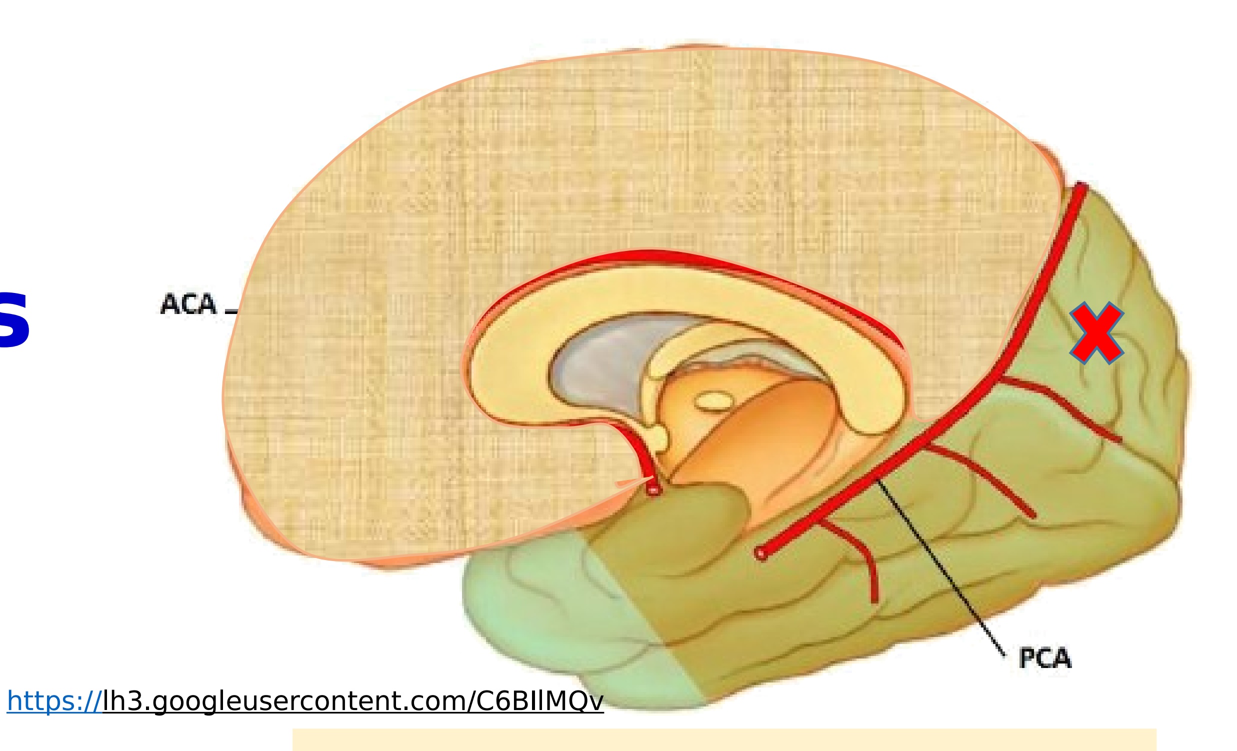
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ACA

nterior cerebral artery

ACA

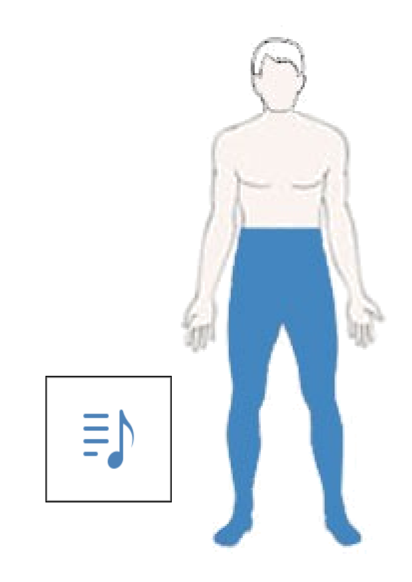
It supplies all medial surface except occipital lobe



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Medial surface

Paraplegia
(loss of movement and sensation in the lower half of the body)



Applied anatomy: ACA supplies the motor & sensory areas of the contralateral lower limb. Occlusion of ACA on one side →paralysis & sensory deficit in contralateral leg. Thrombosis of a congenitally unpaired ACA leads to cerebral paraplegia.

MCA

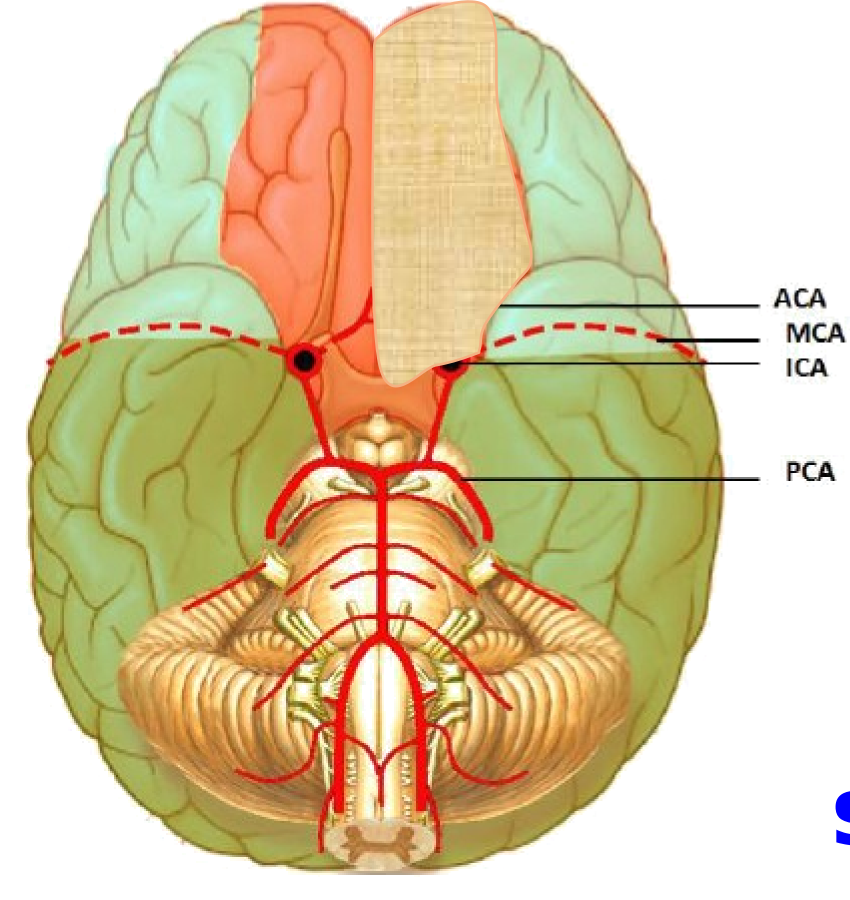
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Lateral surface

ACA

supplies : superior 1 inch of lateral surface.





Inferior surface

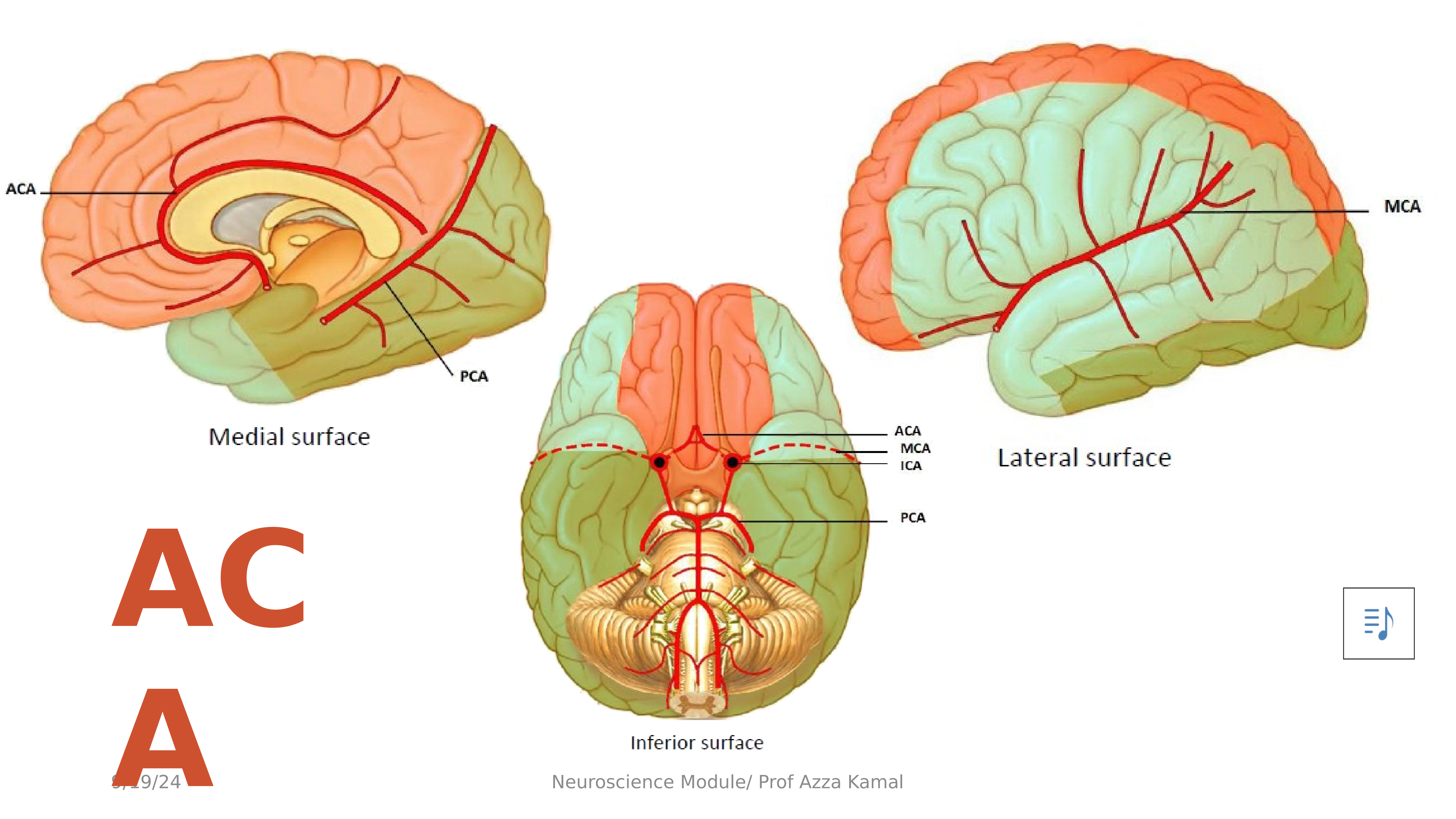
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Inferior surface

ACA

supplies the medial part of orbital surface

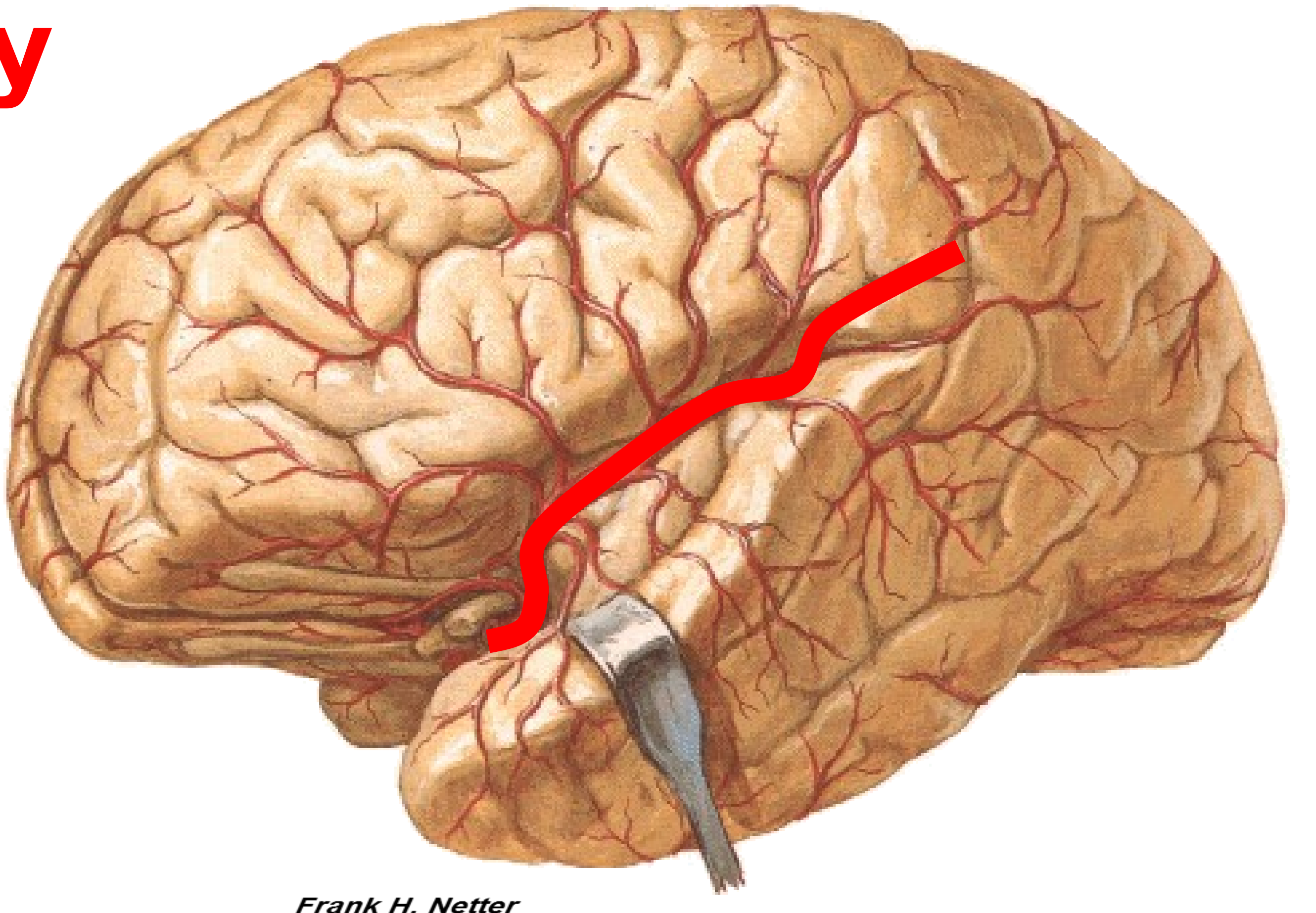



ACA
PCA
Medial surface
ACA
MCA
ICA
PCA
Inferior surface
MCA
Lateral surface
ACA

liddle cerebral artery
MCA

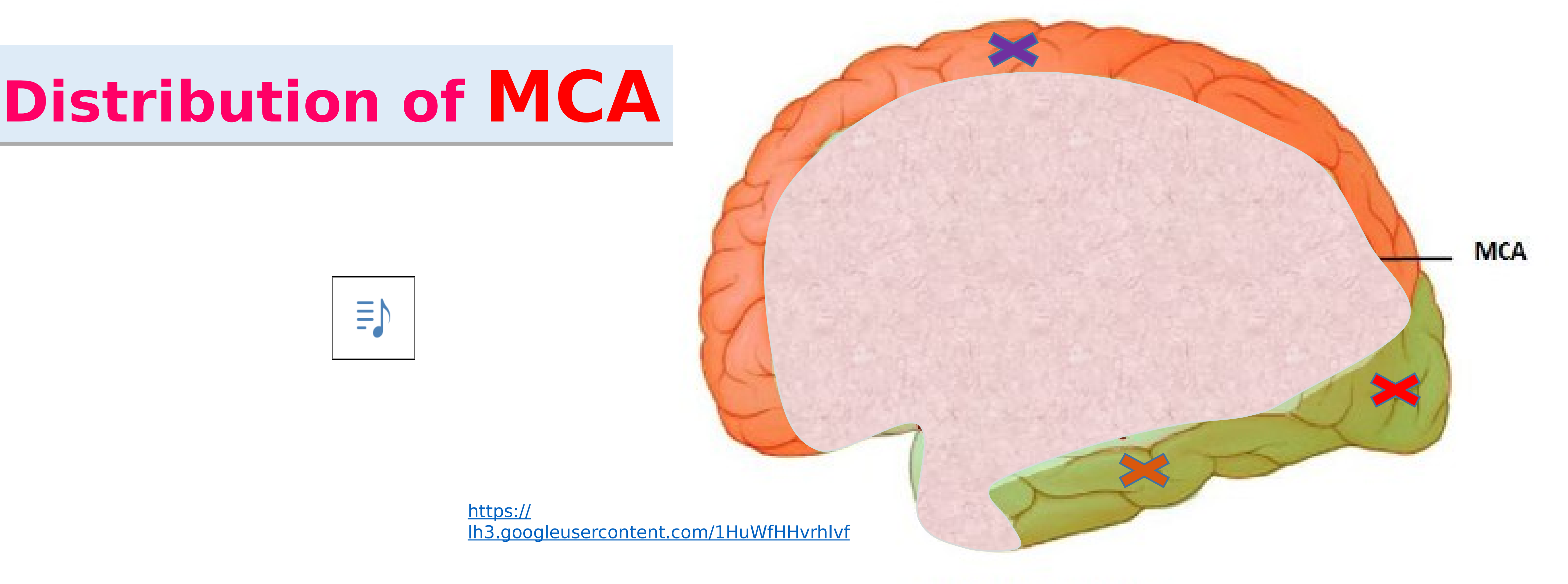
Origin: It is the larger terminal branch of internal carotid artery.

Course: It runs in the lateral sulcus ,crossing the insula to reach the lateral surface of the cerebral hemisphere.





Distribution of MCA



Lateral surface

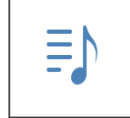
MCA supplies a large area on lateral surface, except occipital lobe + a strip along superior border + a strip along inferior border

Distribution of MCA

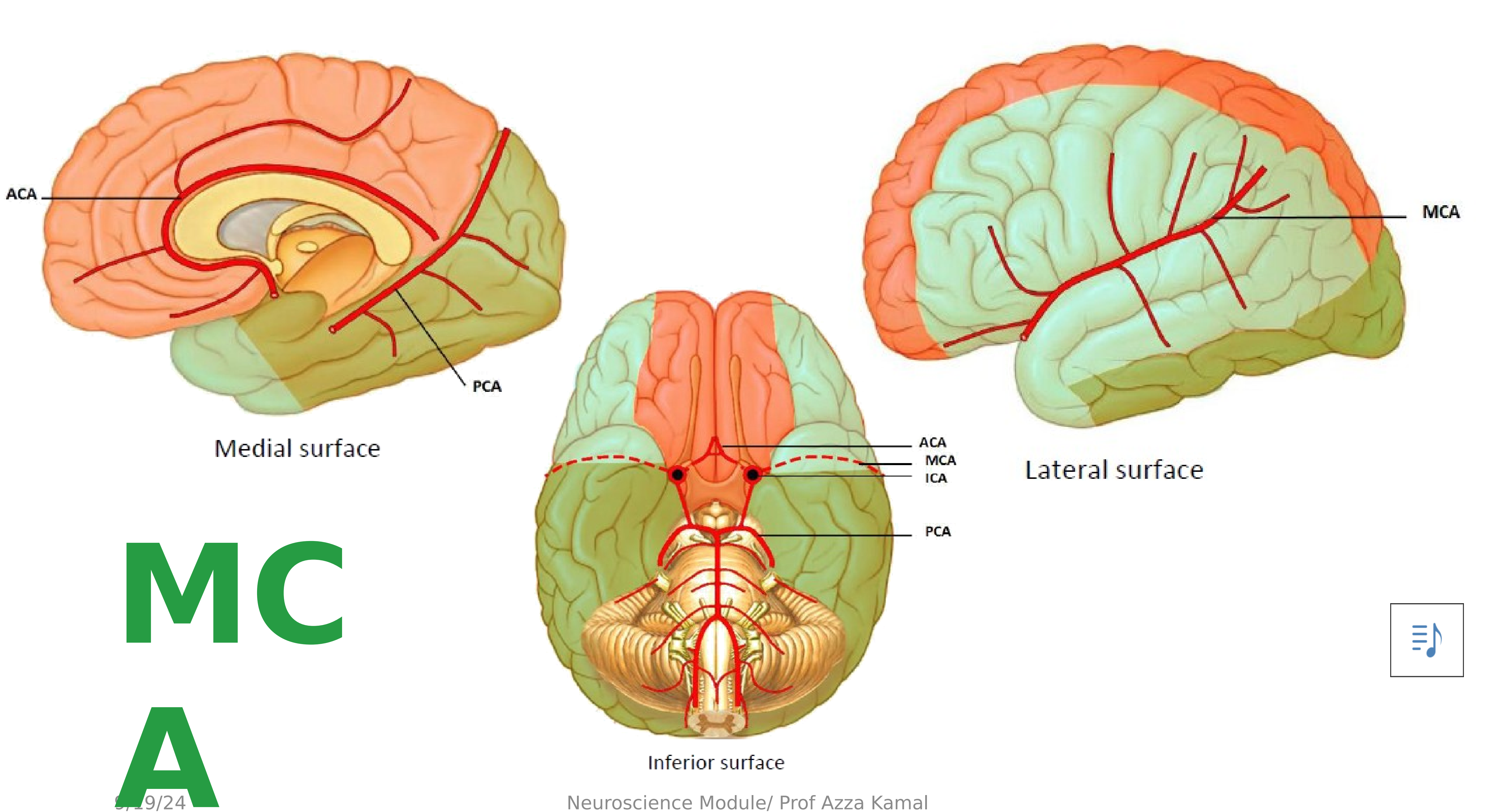
ACA
MCA
ICA
PCA

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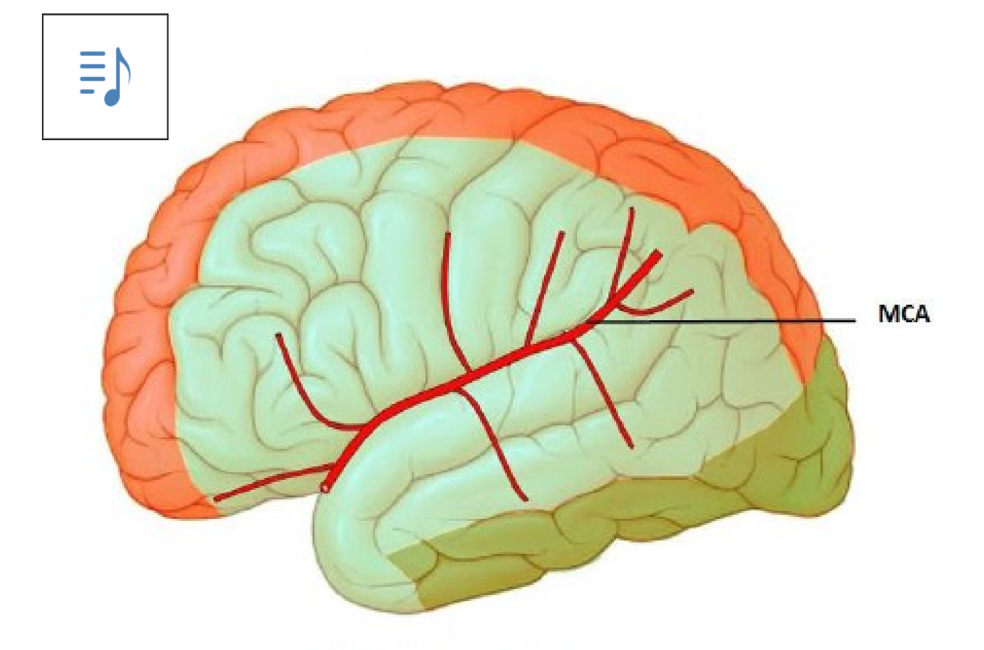
Inferior surface



Inferior surface: MCA supplies
lateral part of orbital surface + temporal pole

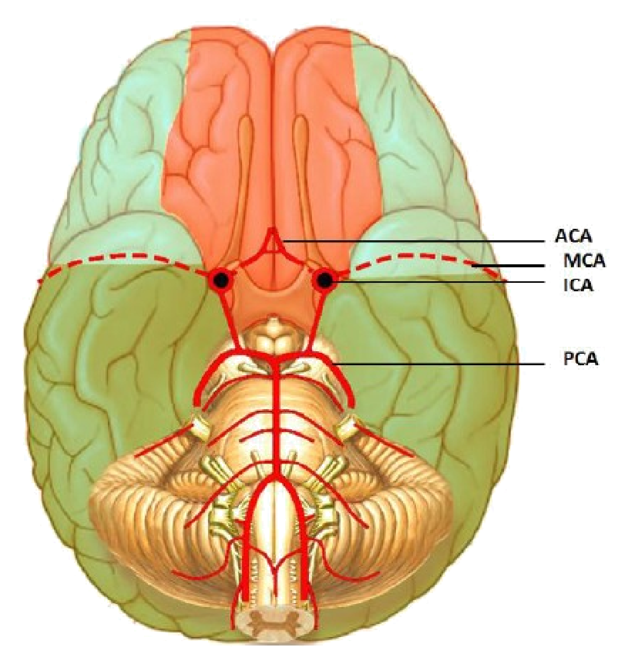

ACA
PCA
Medial surface
ACA
MCA
ICA
PCA
Inferior surface
MCA
Lateral surface

MCA



Lateral surface

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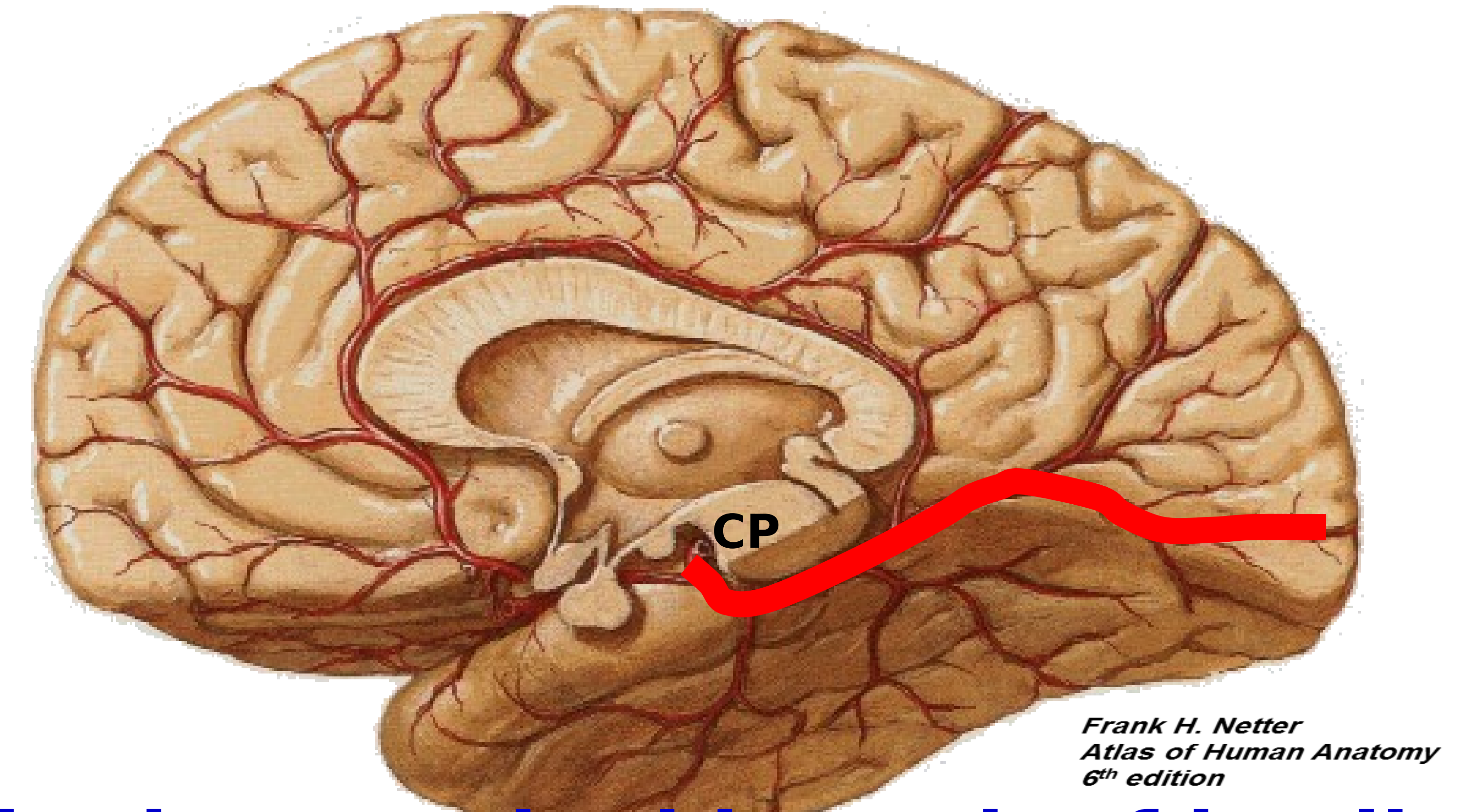
Inferior surface

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Applied anatomy: MCA supplies the motor & sensory areas of the contralateral upper limb ,trunk and face + speech (in dominant hemisphere) & auditory areas + frontal eye field. Its thrombosis is very serious & if occurs on the dominant side aphasia .

Posterior cerebral artery PCA





Origin: It is the terminal branch of basilar artery.
Course: It receives the posterior communicating artery and turns around the cerebral peduncle (CP) to reach tentorial surface of brain, where it

istribution of PCA

MCA

Lateral surface

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Lateral surface: PCA supplies occipital lobe + strip along lower border of the cerebral hemisphere.

Distribution of PCA

ACA

PCA

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Medial surface



Medial surface it supplies the occipital lobe

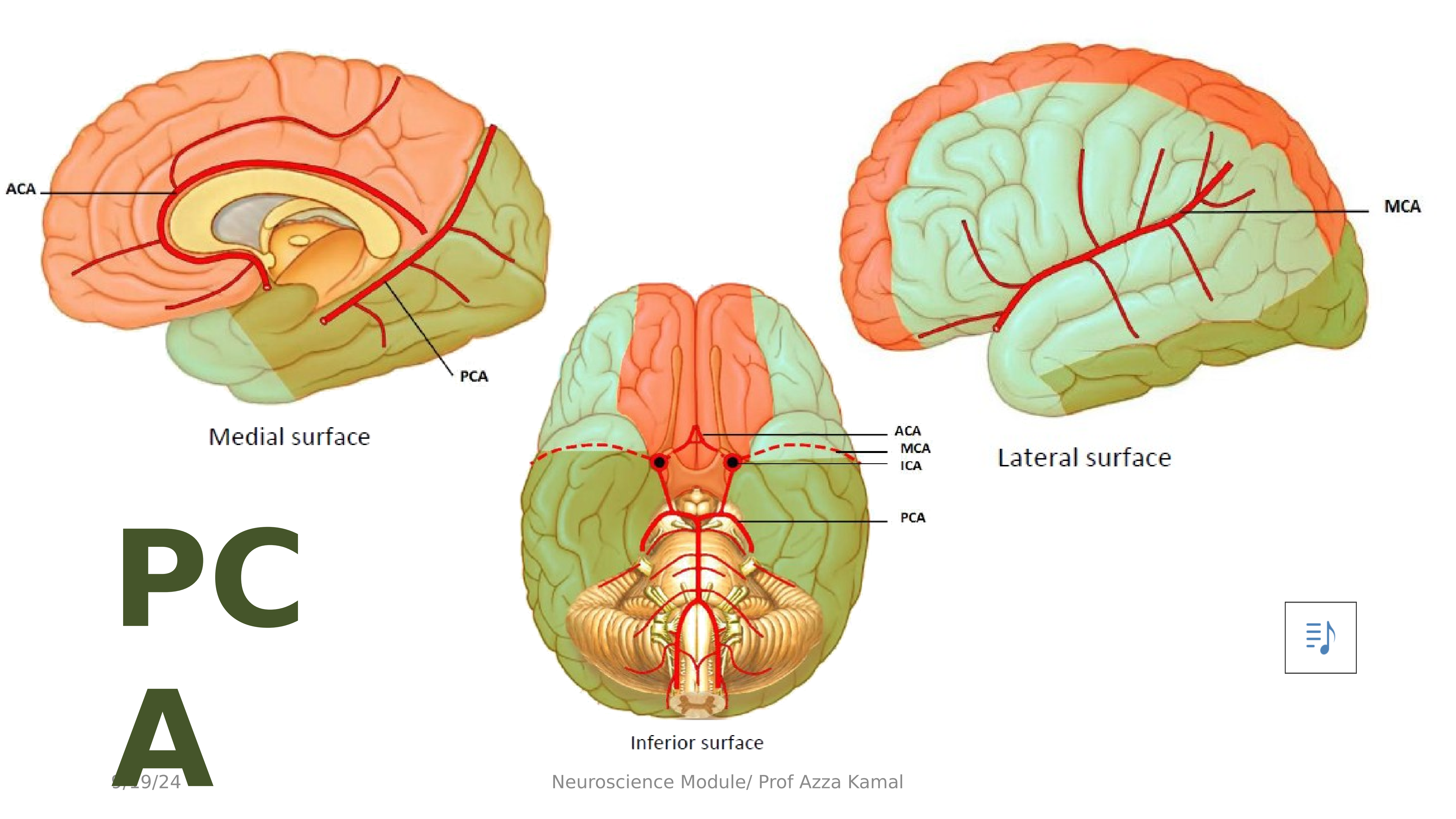
Distribution of PCA

Inferior surface: PCA supplies tentorial part except temporal pole

ACA
MCA
ICA
PCA

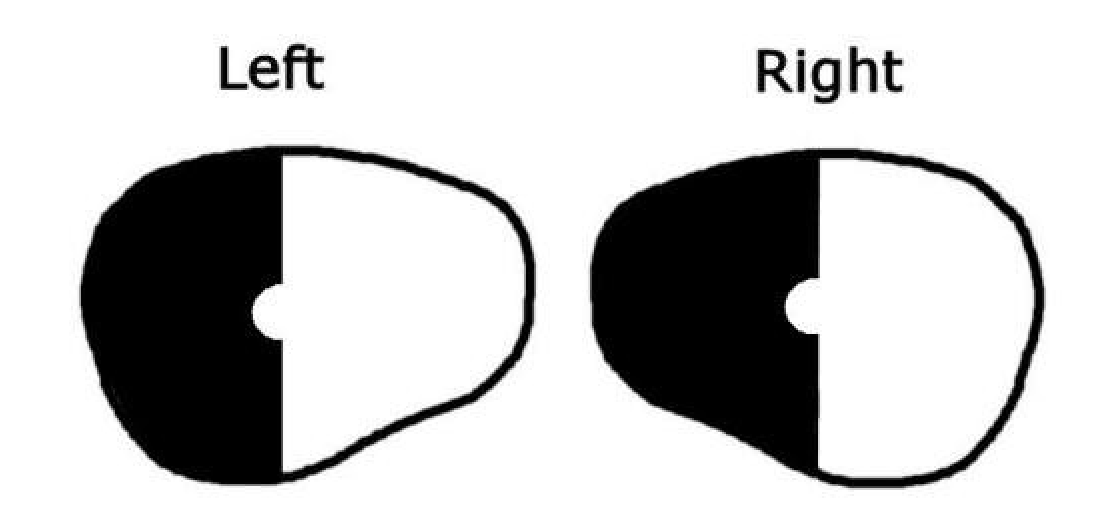
Inferior surface

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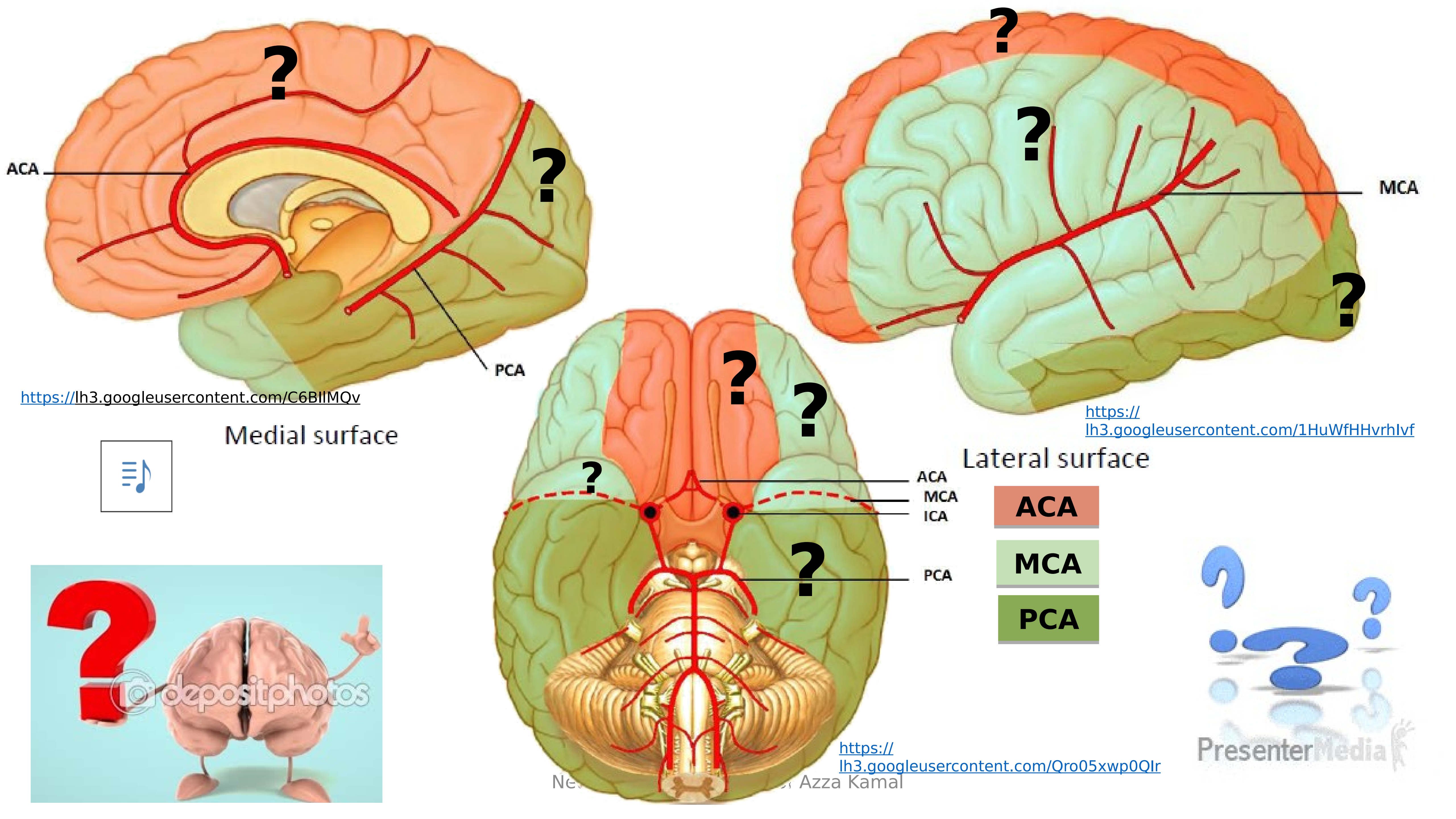

ACA
PCA
Medial surface
ACA
MCA
ICA
PCA
Inferior surface
MCA
Lateral surface
PCA

Applied anatomy:

- **PCA** supplies the visual areas of the contralateral ½ of both visual fields.
- Its occlusion leads to homonymous hemianopia but there is Macular sparing because the branches supplying the macular region have strong anastomosis with the





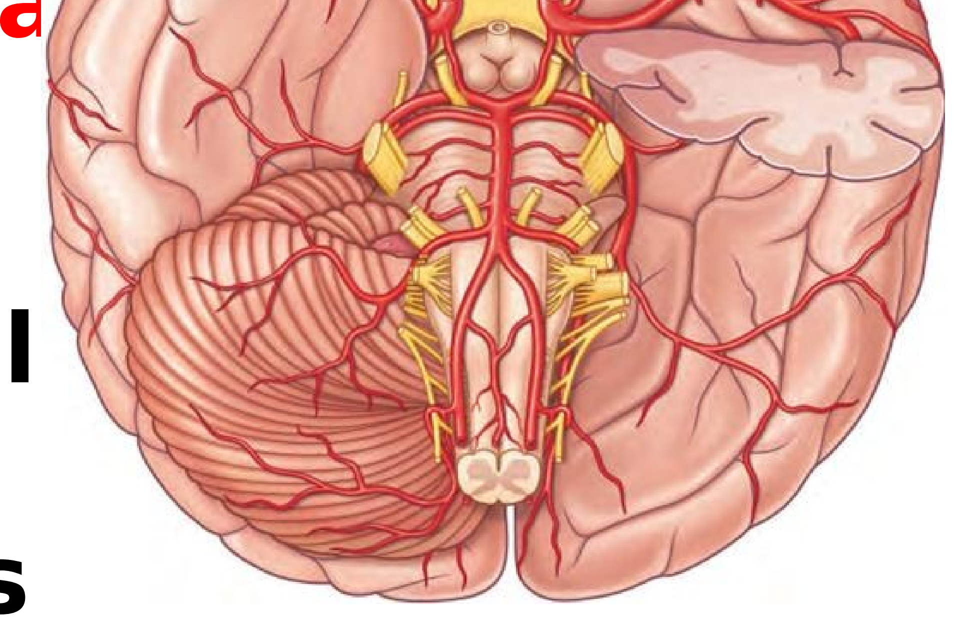


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Lecture Quiz



Which of the following two arteries unite to form the basilar artery?



- **A.** 2 internal carotids
- **B.** 2 middle cerebrals
- **C.** 2 posterior cerebral
- **D.** 2 vertebrals
- **E.** 2 anterior cerebrals

MCQ to test the origin of the basilar artery

Lecture Quiz



Occlusion of which of the following arteries in the dominant hemisphere results in aphasia?

A. Anterior cerebral artery
B. Middle cerebral artery
C. Posterior cerebral artery
D. Posterior choroidal
E. Anterior choroidal



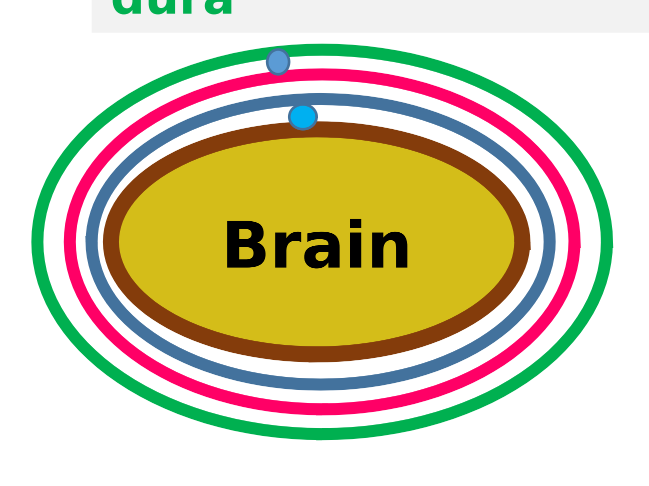




MCQ tests results of occlusion or hemorrhage of the different arteries

Venous drainage

Pia mater
Arachnoid
Inner meningeal layer of dura
Outer endosteal layer of dura



- **Superficial (external) veins:**

Drain the cortical surfaces of the cerebral hemisphere

- **Deep (internal) veins:**

Drain the interior of the cerebral hemisphere.

- **Veins emerge from the brain to the subarachnoid space then pierce the arachnoid and meningeal layer of dura to drain into dural venous sinuses.**



Superficial veins

3 Superficial veins

Superior Sagittal Sinus

1-Superior Cerebral Veins

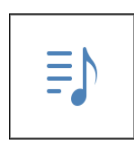
3-Superficial Middle Cerebral V

Anastomotic channels

2-inferior Cerebral Veins

Transverse Sinus

Cavernous Sinus



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Deep Ve

Inf. sagittal sinus

Straight Sinus

Great cerebral V

V.

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-Thalam ein internal cerebra

-The (R ins unite great cerebral vein

Lecture Quiz

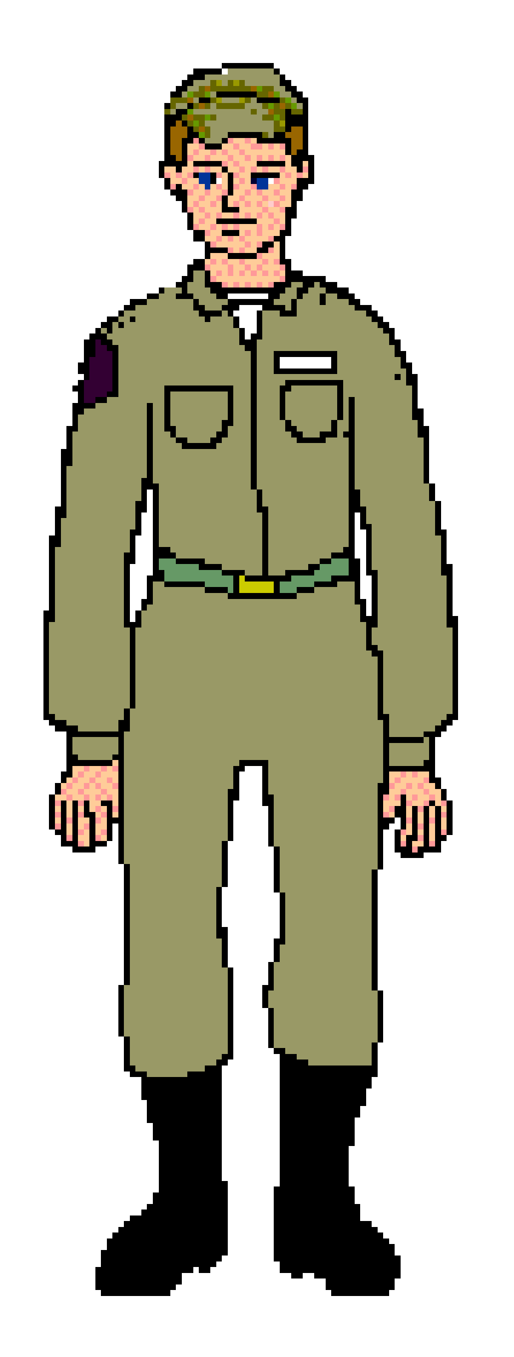


The right and left internal cerebral veins unite to form which of the following?

A. Thalamostriate vein
B. Choroidal vein
C. Inferior sagittal sinus
D. Straight sinus
E. Great cerebral vein

MCQ to test the venous drainage of the brain (deep veins)

Thank You



Reference:
Clinical Neuroanatomy, Richard Snell, 7th edition

